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Sustainable development: promotion of new and renewable sources of energy

Promotion of new and renewable sources of energy

Report of the Secretary-General

Summary

New and renewable sources of energy are perceived not only as an important and valuable option for energy supply but also as key resources for addressing global challenges, including universal energy access, energy security, climate change and ultimately poverty eradication and sustainable development. Continuing technological advances, lower costs and successful deployment and use of renewable energy systems in many developed and developing countries have demonstrated their potential to satisfy energy requirements and to replace other energy sources. As renewable energy markets and industries mature, new opportunities arise, but at the same time different challenges and uncertainties appear. The last two years have seen declining investments globally owing to the international economic crisis, changes in national policy environments and potential competition from new discoveries of unconventional fossil fuel resources. Nevertheless, 2013 and 2014 have seen a continuous increase in global renewable energy use and in the number of countries with renewable energy targets and supporting policies. However, much more needs to be done to make the growth in renewable energy self-sustaining and to pursue the accelerated deployment necessary to achieve critical universal goals.

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I. Introduction

1. The Johannesburg Plan of Implementation calls for action to "substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply".[1] During the last decade the General Assembly has encouraged the United Nations system to continue to raise awareness of the importance of energy for sustainable development and poverty eradication, including the need for the promotion of new and renewable sources of energy and the increased role these sources could play in the global energy supply.

2. Recognizing the important role that energy plays in sustainable development, the General Assembly declared 2012 the International Year of Sustainable Energy for All in its resolution 65/151. Member States and international organizations implemented important initiatives for the promotion of access to modern energy services and for enhancing the use of new and renewable energy technologies.

3. In the outcome document of the 2012 United Nations Conference on Sustainable Development, "The future we want", endorsed by the General Assembly in resolution 66/288, Heads of State and Government and high-level representatives recognized "the critical role that energy plays in the development process, as access to sustainable modern energy services contributes to poverty eradication, saves lives, improves health and helps provide for basic human needs".

4. Furthermore, the Open Working Group of the General Assembly on Sustainable Development Goals has proposed the goal of ensuring access to affordable, reliable, sustainable and modern energy for all, with the following targets for the year 2030: ensuring universal access to affordable, reliable and modern energy services; substantially increasing the share of renewables in the global energy mix; doubling the global rate of improvement in energy efficiency; enhancing international cooperation to facilitate access to clean energy research and technologies; and expanding infrastructure and upgrading technology for supplying modern and sustainable energy services for all in developing countries, particularly least developed countries and small island developing States.[2]

5. Stressing the need for a coherent, integrated approach to energy issues and the promotion of synergies across the global energy agenda for sustainable development, the General Assembly, in its resolution 67/215, declared 2014-2024 the United Nations Decade of Sustainable Energy for All.

6. The present report is submitted in response to the General Assembly resolution 67/215.

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[1] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-6 September 2002* (United Nations Publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, para. 20 (e).

[2] See http://sustainabledevelopment.un.org/focussdgs.html.

II. Overview of new and renewable sources of energy

A. Status

7. The role of renewable energy in global energy supply continues to increase in both developing and developed countries. New and renewable sources of energy are now perceived not only as valid and important energy supply options but also as key resources for addressing global challenges, including universal energy access, energy security, climate change and ultimately poverty eradication and sustainable development. Nevertheless, the overall contribution of new and renewable sources of energy to global energy systems remains limited and the outlook is uncertain owing to a declining trend in investments, negative changes in national support policies in a number of countries and the discovery of new and competitive unconventional oil and gas sources.

8. Despite these trends, during 2012 and 2013 the overall number of countries with new renewable energy policies and targets has increased considerably. Continuing technological advances, lower costs and innovative financing are making renewable energy technologies affordable in an increasing number of countries. Although some renewable energy industries have experienced difficulties owing to continuing consolidation, industries are adapting rapidly with flexibility and diversifying their products while developing global supply chains. At the global level, the initiative of the Secretary-General entitled "Sustainable Energy for All" and the declaration by the General Assembly of 2014-2024 as the United Nations Decade of Sustainable Energy for All have sparked significant commitments to actions that provide strong support for the increased use of new and renewable energy sources. These efforts, combined with those of other international organizations, are key to sustaining the transformation of energy systems and to fuelling the green economies of the future.

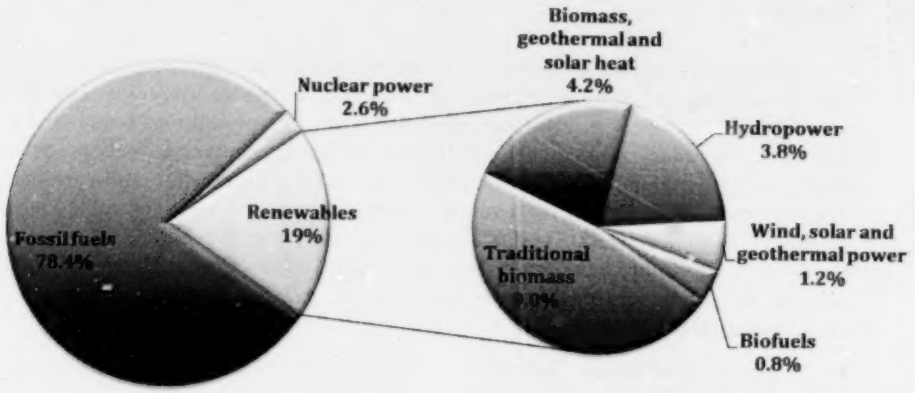
9. Nevertheless, major challenging economic and technological factors are still affecting the large-scale deployment of renewable energy. They include the need for further progress in reducing costs through learning and scale-up; creating a flexible investment environment in many countries; integrating renewable energy technologies into energy systems; enhancing research and development; and assuring the sustainability of renewable energy technologies.[3]

10. Figure I shows fuel shares in global final energy consumption in 2012. The total share of renewable energy reached 19 per cent, up from 18 per cent in 2010.[4] This refers to all forms of consumption including transport, heating, cooling, cooking and power generation. Traditional biomass accounts for 9 per cent of the current renewable energy consumption. Modern renewable energies make up only 10 per cent of total consumption. This includes 4.2 per cent from sustainable biomass, geothermal and solar for heating purposes, 3.8 per cent from hydropower, 1.2 per cent from wind, solar and geothermal for power generation and 0.8 per cent from biofuels for transport.

[3] International Institute for Applied Systems Analysis, *Global Energy Assessment: Toward a Sustainable Future* (Cambridge, Cambridge University Press, 2012), and the International Institute for Applied Systems Analysis, Laxenburg, Austria.

[4] Renewable Energy Policy Network for the 21st Century (REN21), *Renewables 2014: Global Status Report* (Paris, 2014).

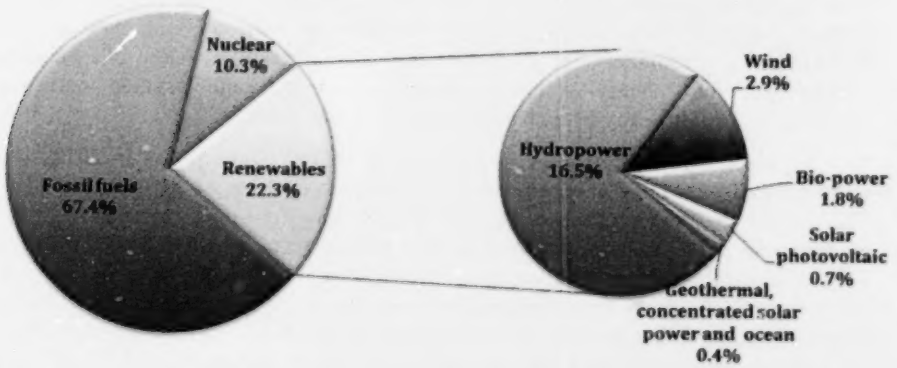
Figure I
Fuel shares in global energy consumption, 2012



Source: Renewable Energy Policy Network for the 21st Century (REN21), *Renewables 2014: Global Status Report* (Paris, 2014).

11. Figure II shows fuel shares in global electricity generation for 2013. The share of renewables in electricity generation rose to 22 per cent from 20 per cent in 2011. Hydropower has the largest share at 16.5 per cent, followed by wind, biopower and solar photovoltaic, respectively. Electricity generated globally by renewable energy sources other than hydropower represents only 5.8 per cent.

Figure II
Fuel shares in global electricity generation, 2013

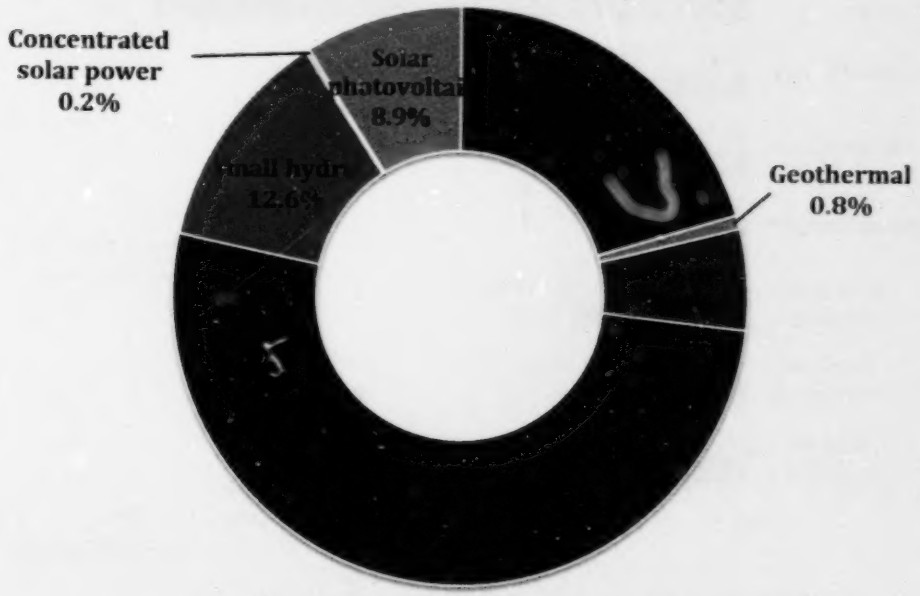


Source: REN21, Renewables 2014: Global Status Report (Paris, 2014). The nuclear share is based on estimates of nuclear electricity generation for 2013 by the International Atomic Energy Agency.

12. In terms of electric power capacity, the overall global renewable electric power capacity increased to 1,560 gigawatts in 2013 from 1,440 gigawatts in 2012. The

renewable electric capacity in 2013 represented more than 25 per cent of the global electric power generating capacity estimated at 6,194 gigawatts for 2013. The overall increase in 2013 is the result of increases in capacities of hydropower, bio-power, geothermal, solar photovoltaic, concentrated solar power and wind.[5] Figure III shows shares of global renewable electric power capacity by renewable source. Large hydropower has the largest capacity share at 52 per cent, followed by wind at 22 per cent and solar photovoltaic at 9 per cent.[6]

Figure III
Shares of global renewable electric power capacity, 2013



Source: UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2014* (Frankfurt, Frankfurt School of Finance and Management, 2014). Large hydro data were taken from REN21, *Renewables 2014: Global Status Report* (Paris, 2014).
Note: Large hydropower refers to plants with capacities of more than 50 megawatts.

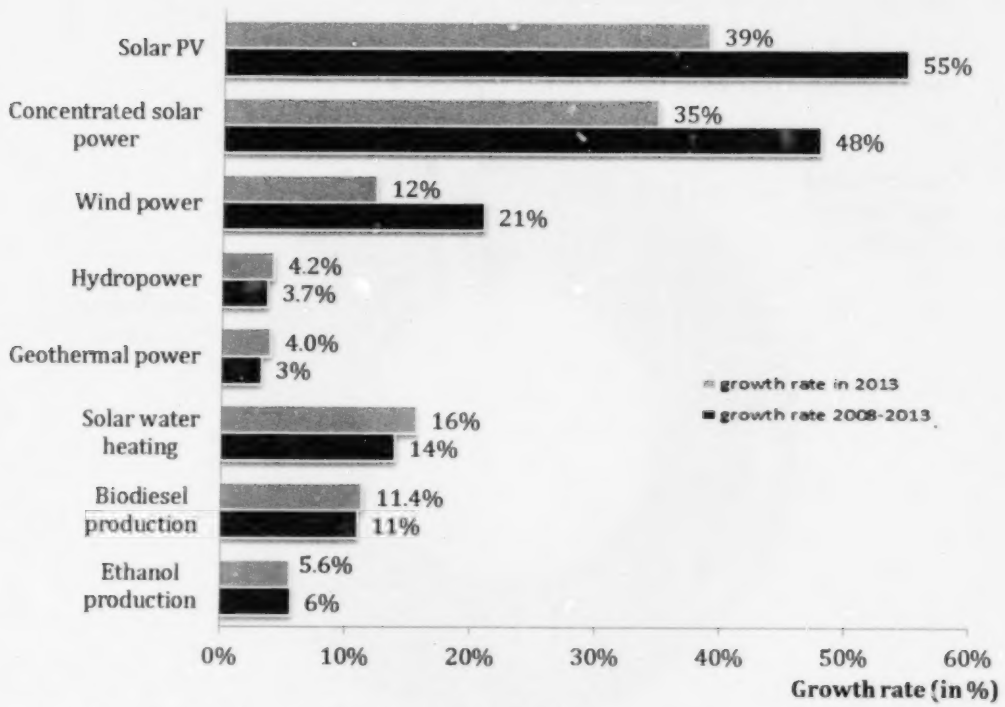
13. The global installed renewable energy capacity without large hydropower amounted to 735 gigawatts in 2013. This new renewable energy capacity accounted for 43.6 per cent of the overall new generating capacity that was installed globally in 2013 from all sources. This increase in renewable energy use avoided a total of 1.2 gigatons of CO_2 emissions.[7]

14. Figure IV shows the annual growth rates of renewable energy capacity and biofuel production for the five-year period 2008-2013 and for the year 2013. Most

[5] Ibid.
[6] Large hydropower in the present report refers to hydropower plants with capacities of more than 50 megawatts.
[7] UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2014* (Frankfurt, Frankfurt School of Finance and Management, 2014).

new and renewable energy sources grew at an accelerated pace during the 2008-2013 period.

Figure IV
Average annual growth rate of renewable energy capacity and biofuel production, 2008-2013 and 2013



Source: REN21, *Renewables 2014: Global Status Report* (Paris, 2014).
Abbreviations: PV, photovoltaic.

Solar photovoltaic and concentrated solar power experienced the highest growth rates during this period at 55 per cent and 48 per cent, respectively. However, capacity growth in 2013 slowed down for concentrated solar power, solar photovoltaic and wind compared to the last five-year average. In terms of countries' installed capacity, as at the end of 2013, China led the world in total renewable energy, followed by the United States, Germany and Spain.[8] Between 2009 and 2013, Turkey increased its renewable energy capacity the most, growing by 28 per cent. Turkey was followed by the United Kingdom and Italy (both at 25 per cent) and China, the Republic of Korea and South Africa (at 23 per cent over the five-year period).[9]

[8] The Pew Charitable Trusts, *Who's Winning the Clean Energy Race?*, 2013 edition (Philadelphia, 2014).
[9] Ibid.

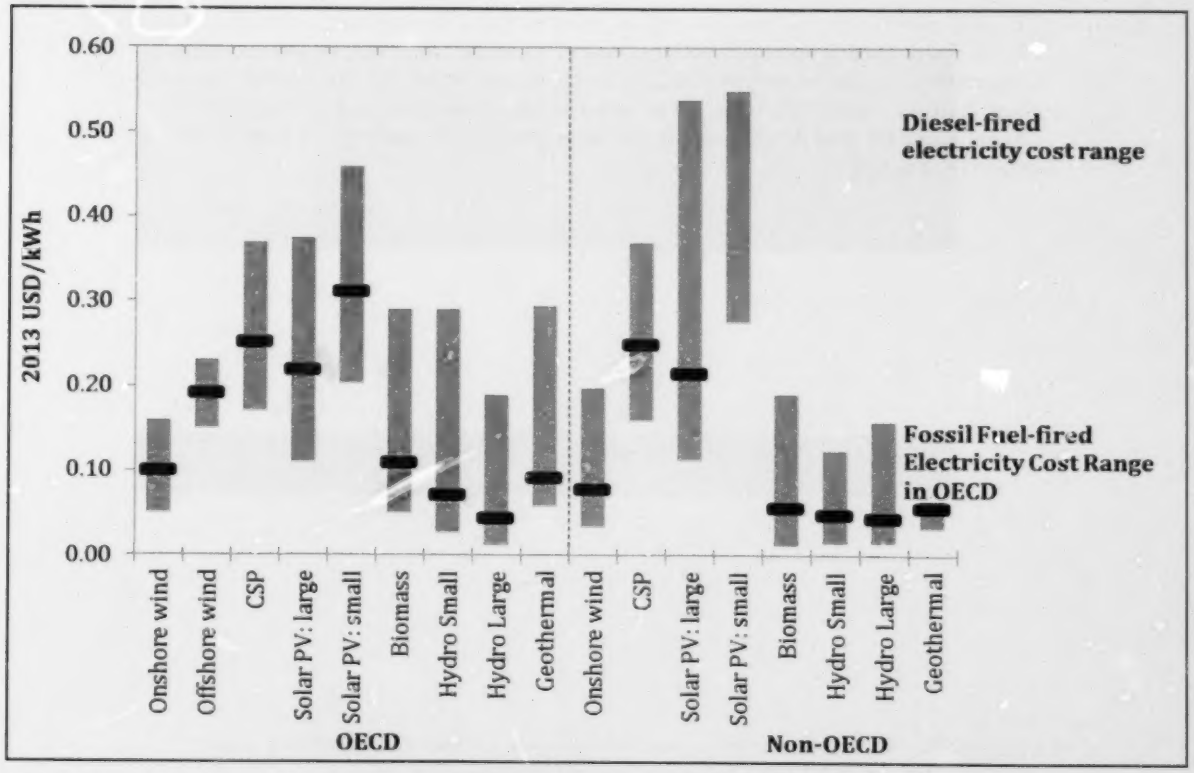
Costs

15. Cost estimate comparisons of energy systems vary considerably and depend on many factors and assumptions. The cost of renewable energy generation depends not only on the technology employed but also on the plant's capacity, location and surrounding infrastructure. The cost-effectiveness of renewable energy technologies in countries and regions depends on the availability of the resource.

16. Figure V presents estimated ranges for electricity generation costs by technology for 2012. The costs are levelized but exclude all subsidies and policy incentives. These costs include equipment cost, performance, balance of system cost, operation, maintenance, fuel/feedstock and the 10 per cent cost of capital across the lifespan of the plant.

17. The cost estimates also exclude transmission and distribution costs. These costs are highly dependent on the existing grid and the size of the power plant. Distributed renewable energy technologies and off-grid systems most often do not require additional transmission investments, while large-scale renewable power production necessitates appropriate grid infrastructure.

Figure V
Electricity cost estimate ranges by technology



Source: International Renewable Energy Agency (IRENA), renewable cost database, June 2014.
Note: The electricity cost estimates include 10 per cent capital cost.
Abbreviations: USD, United States dollars; kWh, kilowatt-hours; OECD, Organization for Economic Cooperation and Development; CSP, concentrated solar power; PV, photovoltaic.

18. Renewable energy today represents one of the most cost-effective solutions for off-grid areas and has a cost advantage over diesel-fired power generation. The costs are also competitive, in some cases, with electricity generated with fossil fuels.

19. The highest cost reductions over the past five years took place in the solar photovoltaic sector, with levelized cost decreases of 34 per cent for thin-film photovoltaic, 53 per cent for crystalline silicon photovoltaic and 49 per cent for crystalline silicon photovoltaic with tracking.[10]

20. Onshore wind is now about 15 per cent less costly than five years ago and comparable to combined-cycle gas turbines or coal-fired power plants. Offshore wind, on the other hand, experienced a 41 per cent increase in costs per megawatt-hour.[11] Solar thermal electricity generation and concentrated solar thermal power have seen only minor cost improvements.[12]

21. Owing to the decreasing cost of renewable energy technologies, record levels of new renewable energy capacity were installed in the last two years, while absolute investment dropped.

22. Figure VI shows the typical capital cost ranges for electricity for each technology. Capital cost refers to the total installed costs, which vary between countries and regions.

23. The average capital cost for onshore wind projects, for instance, is lower in the United States than in the other member countries of the Organization for Economic Cooperation and Development (OECD). In China and India, the same plant type is about half as capital-intensive, since wind turbines are produced at lower costs. Capital costs are also determined by the local labour cost, maturity of markets and incentive structures.[13]

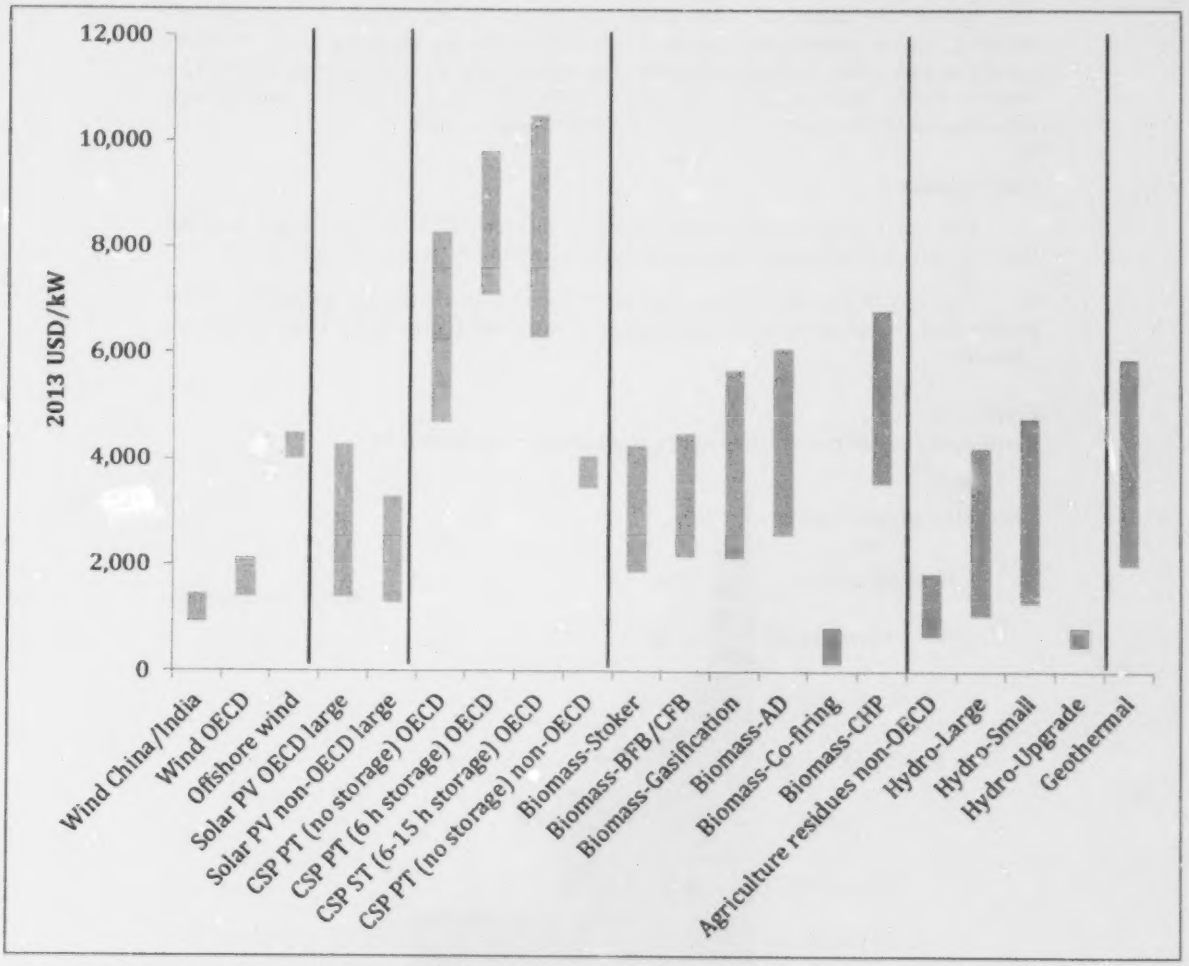
[10] UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2014* (Frankfurt, Frankfurt School of Finance and Management, 2014).

[11] Ibid.

[12] Ibid.

[13] International Renewable Energy Agency (IRENA), *Renewable Power Generation Costs in 2012: An Overview* (Abu Dhabi), 2013.

Figure VI
Typical capital cost ranges by technology



Source: IRENA, renewable cost database, June 2014.

Abbreviations: USD, United States dollars; kW, kilowatts; OECD, Organization for Economic Cooperation and Development; CSP PT, concentrated solar power parabolic trough; CSP ST, concentrated solar power solar thermal; PV, photovoltaic; PT, parabolic trough; BFB, bubbling fluidized bed; CFB, circulating fluidized bed; AD, anaerobic digestion; CHP, combined heat and power.

24. The price of conventional power generation has increased over the past five years owing to labour expenses and the cost of steel and, in the nuclear sector, extensive safety reviews. The natural gas market in the United States is an exception owing to its rapid development resulting from increased shale production. Natural gas prices in Europe and Asia are about twice as high as prices in the United States.

25. The decrease in renewable energy production costs has also triggered reduced subsidies in the sector. Germany's feed-in tariff for ground-mounted solar photovoltaic projects decreased from 35 euro cents per kilowatt-hour in 2008 to

9.38 euro cents per kilowa -hour in 2014. The United Kingdom has undergone similar developments.[14]

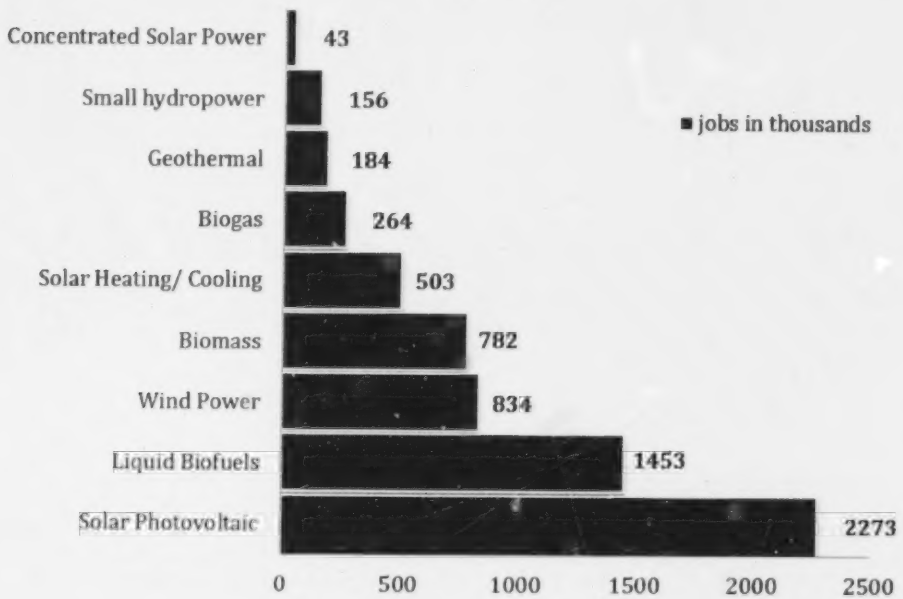
26. While the share of renewables in electricity production is continuously growing, the situation in non-power sectors is less encouraging. The transport sector, in particular, is lagging behind. The growth rate of conventional biofuel use slowed down between 2011 and 2013. Only 2.5 per cent of the total energy consumption in transport was covered by renewables in 2010.[15]

Employment

27. The latest estimates of employment in the renewable energy sector indicate that currently 6.5 million people work directly and indirectly for the industry.[16]

28. Figure VII shows the distribution of jobs in the different industries. Solar photovoltaic leads in terms of employment creation with almost 2.3 million workers globally.

Figure VII
Estimated jobs in renewable energy worldwide by industry, 2013



Source: IRENA, *Renewable Energy and Jobs Annual Review 2014* (Abu Dhabi, 2014).

29. Employment remains concentrated in the same countries as in previous years. More than a third of all renewable energy jobs are located in China, with 2.6 million. The European Union is second with 1.1 million, followed by Brazil, the United States and India. Germany alone has 371,000 jobs, and Spain 114,000.

[14] Ibid.
[15] IRENA, *Road Transport: The Cost of Renewable Solutions* (Abu Dhabi, 2013).
[16] IRENA, *Renewable Energy and Jobs Annual Review 2014* (Abu Dhabi, 2014).

30. Germany, France and Italy suffered job losses in the solar photovoltaic industry, while the rest of the European Union experienced employment creation, mostly in solid biomass, and to a smaller extent also in liquid biofuels, biogas and the geothermal industry.

31. Brazil has seen the most employment in the field of bioenergy, while 1.6 million people were employed by the Chinese solar photovoltaic industry.

Other factors affecting renewable energy growth

32. In 2012, global fossil fuel subsidies expanded to $544 billion[17] from $523 billion in 2011. Factoring in externalities, fossil fuel subsidies have been estimated at $1.9 trillion.[18] Fossil fuel subsidies hamper renewable energy development and create an uneven playing field. Externalities from conventional energy sources are not factored into their price, which distorts markets and hinders new entrants. Overcoming these market imbalances requires coherent policies and a reduction of fossil fuel subsidies. In 2009, the Group of 20 committed itself to phasing out fossil fuel subsidies and reinforced the decision at the finance ministers' meeting in February 2013.

33. Renewable energy subsidies can help new technologies penetrate markets and create economies of scale. However, many countries are currently cutting back on renewable energy subsidies owing to their individual economic and political considerations.

34. Unconventional gas is expected to play an important role in future global energy systems. Based on recent assessments, 137 unconventional gas formations in 41 countries have been discovered. Geological conditions, regulatory frameworks and market conditions will determine the rate and pace of development in each region.[19] The positive cost development of unconventional fuel exploitation is slowing down renewable energy investments.

35. Following the Fukushima nuclear accident, several countries introduced plans to scale back their nuclear power generation. The United States, the European Union and China conducted safety reviews. A rapid nuclear phase-out, as envisaged in Germany, Italy, Switzerland and Japan, might lead to increased fossil fuel and renewable energy use.

B. Investments

36. Global investment in renewable energy decreased for the second consecutive year in 2013, amounting to $214 billion. This constitutes a 14 per cent decrease from 2012 and a 23 per cent decrease from 2011.[20]

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[17] OECD/International Energy Agency (IEA), "World Energy Outlook 2013 Factsheet" (Paris, 2013).

[18] REN21, *Renewables 2013: Global Status Report* (Paris, 2013).

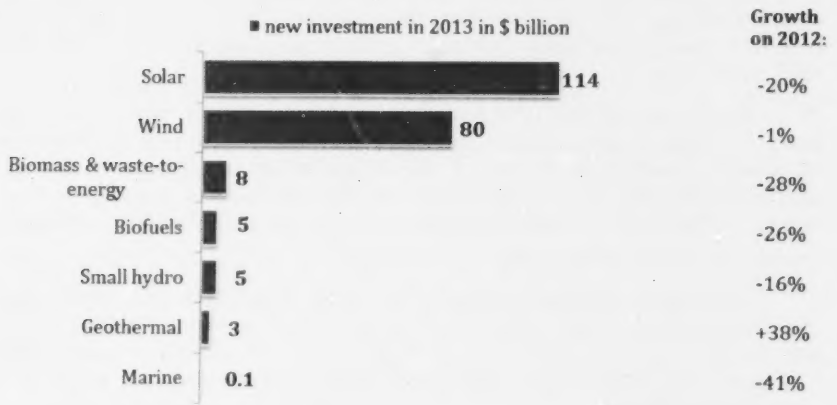
[19] OECD/IEA, *World Energy Outlook 2013* (Paris, 2013); REN21, *Renewables 2013: Global Status Report* (Paris, 2013).

[20] UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2014* (Frankfurt, Frankfurt School of Finance and Management, 2014). Please note that the investment figures from this source do not cover large hydropower. This source notes that large hydropower technology "has been mature for decades and is at a very different stage of its roll-out than, for instance, wind or solar".

37. The slowing of investment rates was partly due to policy uncertainty, high prices of feedstock and decreased technology costs. Prices for solar systems dropped steeply, resulting in the installation of a record amount of solar photovoltaic capacity in 2013. The 39 gigawatts added that year came at a lower cost than the 31 gigawatts built in 2012. The prices of publicly traded clean energy shares improved by 54 per cent. This development facilitated equity raising. Public market equity increased 201 per cent, while venture capital decreased by 46 per cent and asset finance by 13 per cent.

38. Figure VIII shows new investments in renewable energy in 2013 and net changes from the year 2012. Investments decreased in all types of renewable energy except for geothermal. Investments in solar decreased by 20 per cent, biofuel investments decreased by 26 per cent, reaching a nine-year low, while biomass and waste-to-energy investments fell by 28 per cent. Geothermal increased by 38 per cent and investments in wind energy remained relatively stable.[21]

Figure VIII
Global new investment in renewable energy in 2013 and per cent change from 2012



Source: UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2014* (Frankfurt, Frankfurt School of Finance and Management, 2014).

39. China, once again, led the top five renewable energy investors in 2013, followed by the United States and Japan. Over the past five years, investment grew fastest in South Africa (96 per cent), followed by Japan (57 per cent), Australia (32 per cent) and the United Kingdom (18 per cent).[22]

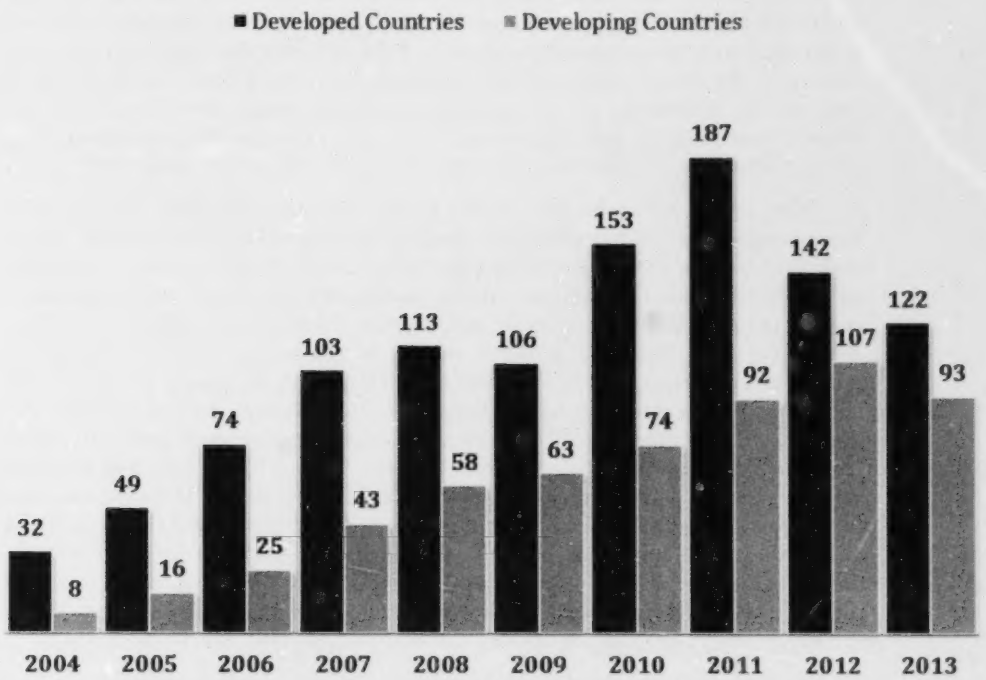
40. For the first time in eight years, investments in developing economies fell by 14 per cent. Nevertheless, China overtook Europe in its total spending. The Americas and Asia-Oceania saw an overall rise in investments.

[21] Ibid.

[22] The Pew Charitable Trusts, *Who's Winning the Clean Energy Race?*, 2013 edition (Philadelphia, 2014).

41. Figure IX shows global new investment in renewable energy for developing and developed countries for the years 2004-2013. Developing countries increased their share in global renewable energy investment in 2012, to a record 46 per cent compared to 34 per cent in the previous year. Along with China, South Africa and Morocco emerged as active performers. On the other hand, developed economies experienced a sharp fall in 2012 owing to lower investment in the United States and Germany.[15]

Figure IX
Global new investment in renewable energy
(Billions of United States dollars)



Source: UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2014* (Frankfurt, Frankfurt School of Finance and Management, 2014).

III. Promotion of new and renewable sources of energy

A. Sustainable Energy for All

42. Extraordinary progress has been achieved since 2011, when the Secretary-General's initiative on "Sustainable Energy for All" was launched and the General Assembly declared 2012 as the International Year of Sustainable Energy for All.[23] Remarkable support and ample mobilization by many stakeholders are helping to

[23] For more information, please see www.se4all.org.

move forward at an accelerated pace the three major global objectives of the initiative: ensuring universal access to modern energy services, doubling the rate of improvement in energy efficiency and doubling the share of renewable energy in the global energy mix by 2030. The initiative is now being guided by an Advisory Board co-chaired by the Secretary-General and the President of the World Bank. The Board includes over 40 eminent persons from government, business, civil society and international organizations. In June 2013, the Secretary-General appointed Kandeh K. Yumkella as his Special Representative for Sustainable Energy for All and Chief Executive of the Sustainable Energy for All initiative.

43. The United Nations Decade of Sustainable Energy for All, 2014-2024, is expected to generate further support and momentum. In declaring the Decade in its resolution 67/215, the General-Assembly recognized the importance and urgency of tackling the global energy challenges for achieving the critical objectives of poverty eradication and sustainable development. This followed the declaration by world leaders at the 2012 United Nations Conference on Sustainable Development that "we are all determined to act to make sustainable energy for all a reality and, through this, help to eradicate poverty and lead to sustainable development and global prosperity" (General Assembly resolution 66/288, annex, para. 129).

44. One of the main outcomes of the United Nations Conference on Sustainable Development was the agreement by Member States to develop an integrated set of "sustainable development goals" to carry forward and further expand the objectives of the Millennium Development Goals, broadening the scope to incorporate all critical issues affecting sustainable development. In the framework of this effort, a stand-alone and dedicated goal on energy is being considered to confirm the importance of energy as a key enabler of sustainable development for all countries and all people. A sustainable development goal for energy and its corresponding targets will promote global awareness of energy challenges and will further facilitate long-term public and financial support, especially for new and renewable sources of energy. The work of the Sustainable Energy for All initiative facilitated the discussions on a sustainable development goal for energy and will represent an important starting reference point for the pursuit of this goal and corresponding targets. Given the right set-up, the Sustainable Energy for All initiative could also present a useful framework for the implementation and tracking of progress towards achieving energy goals and targets as part of the sustainable development goals.

45. In June 2014, the first annual Sustainable Energy for All Forum was organized to assess progress on sustainable energy since the United Nations Conference on Sustainable Development in 2012 and to celebrate the first year of the United Nations Decade of Sustainable Energy for All. The Forum was a very successful event that brought together more than 1,000 leaders from all sectors and countries, including more than 20 attendants at a ministerial level or above. As the focal point of a global network, it provided a valuable meeting place and platform for showcasing success stories and best practices, presenting new commitments, catalysing actions and helping shape the global energy debate for the next decade. A major campaign on energy, women and children and health was also launched at the same event. The next Forum will be held in New York in 2015.

46. By mid-2014, 83 developing countries had "opted in" and joined the efforts of Sustainable Energy for All. Country action plans are under way in almost 30 countries and a total of 43 rapid assessments or gap analyses have been carried

out. Progress is being reported by many countries, including Brazil, Ethiopia, Ghana, Liberia, Sierra Leona and Nicaragua. Some of the progress in the different countries results from partnerships with institutions or initiatives such as the World Bank, the International Energy and Climate Initiative (Energy+), the United Nations Foundation and the Inter-American Development Bank.

47. During the 2014 Forum, many partners of Sustainable Energy for All provided progress updates and showcased success stories. These included Bank of America, the African Development Bank, Power Africa, the European Commission, the European Bank for Reconstruction and Development, the Energy and Resources Institute, the OPEC Fund for International Development and Eni S.p.A.

48. Another accomplishment is the Sustainable Energy for All global tracking framework. This is a global data platform and monitoring system designed to allow rigorous and transparent monitoring of progress towards the three major Sustainable Energy for All objectives through 2030. A consortium of 15 agencies co-led by the World Bank and the International Energy Agency (IAE) produced the first report of the global tracking framework in 2013 and is planning regular updates from 2015 onward.

49. As a contribution to the Sustainable Energy for All initiative, IRENA released the study entitled *REmap 2030: A Renewable Energy Roadmap*. Under current policies, the share of renewables in total final energy consumption will only increase to 21 per cent by 2030. *REmap 2030*, however, demonstrates that it is affordable and feasible with current technology to double the share of renewable energy by 2030. In fact, when accounting for externalities such as climate change and human health, cost savings would be incurred. The *REmap 2030* results are based on real-life analysis encompassing 26 countries which represent three-quarters of current energy demand. *REmap 2030* determines the realistic potential for countries, regions and the world to scale up renewables in order to ensure a sustainable energy future and underscores the pivotal importance of international cooperation and action in the power generation, building, transport and industry sectors to advance this goal.[24]

B. National efforts

50. By early 2014, 138 countries had renewable energy policies in place, as compared to 127 in 2013. More than two thirds of these countries were developing countries or emerging economies.[25]

51. Policymakers in many countries recognize the benefits of renewable energy and its positive impact on energy access, particularly as off-grid and mini-grid solutions in rural and remote areas. Such solutions serve as enablers for health care, food security, water access, education, gender equality and job creation.

52. The most-used renewable energy policy is the feed-in tariff that is now in place in 71 countries. Also common are quotas, known as renewable portfolio standards. These are used in 22 countries and on the subnational level also in the United States, Canada and India. Another policy option is renewable energy

[24] IRENA, *REmap 2030: A Renewable Energy Roadmap* (Abu Dhabi, 2014).
[25] REN21, *Renewables 2014: Global Status Report* (Paris, 2014).

certificates. These are often used in conjunction with renewable portfolio standards. Since 2012, Norway and Sweden have jointly established a green certificate market, while Australia has decreased the number of certificates by 50 per cent.

53. Many countries also employ fiscal incentives to mediate the barriers that hinder renewable energy deployment and investments. For example, Cameroon exempted renewable energy products from the value added tax and Madagascar decreased the import taxes on renewable energy equipment by 50 per cent.

54. While countries around the world provide financial support to renewable energy projects and technology development, many have cut back their renewable energy subsidies in recent years, including China, the United Kingdom and Estonia. Spain and the Czech Republic cut all financial support in 2012.

55. Several existing renewal energy targets were set to be achieved by 2012, which led to a host of new commitments and adjusted targets. India met its wind energy targets and introduced a five-year plan doubling the renewable capacity by 2017. India will add 5.6 gigawatts thermal of solar water heating capacity by 2017, and the newly-elected Prime Minister announced the electrification of rural areas, intended to bring solar power to 400 million people by 2022.[26]

56. Japan is developing its wave and tidal capacity. China has set a target of 9.5 per cent of primary energy consumption to be generated from renewable sources. In China the new renewable electricity capacity exceeded for the first time the new fossil fuel and nuclear capacities. China has committed over $67 billion in investments in renewable energy.

57. The Economic Community of West African States is now operating under a regional renewable energy policy and aims to achieve 10 per cent renewables in the electricity mix by 2020 and 19 per cent by 2030.

58. In the European Union, the new renewable electric capacity has had the largest share of all forms of new electric capacity built in the last six consecutive years. Austria has the ambitious target of 85 per cent of electricity consumption to be satisfied by renewables in 2020. Denmark will generate 50 per cent of total electricity consumption in 2020 with wind. Denmark also banned in 2013 the use of fossil fuel-fired boilers in new buildings, aiming to have renewables generating 40 per cent of the heat supply by 2020. France's international development support strategy includes the use of 2 billion euros for developing countries for renewable energy and energy efficiency for the next three years.

59. In the Americas, Mexico increased its target to 35 per cent of electricity from renewable sources by 2026. In Nicaragua, the National Sustainable Electrification and Renewable Energy Programme, with international financial support, electrified 36,300 households in 2013 and is aiming to increase electricity access from 72 per cent in 2012 to 85 per cent in 2016.

60. The United States announced in 2013 the Power Africa initiative to double the number of people with access to power in sub-Saharan Africa. Power Africa is working with partners in six focus countries (Ethiopia, Ghana, Kenya, Liberia, Nigeria and the United Republic of Tanzania). The objective is to add more than

[26] Clean Technica, "Narendra modi plans to bring solar to 400 million people, electrify rural India", 26 May 2014. Available from http://cleantechnica.com/2014/05/26/narendra-modi-plans-bring-solar-400-million-people-electrify-rural-india//. Retrieved 10 June 2014.

10,000 megawatts of clean, efficient electricity generating capacity. For the first five years, the United States Government has committed more than $7 billion in financial support and loan guarantees. A sub-initiative called Beyond the Grid is designed to drive investments specifically for off-grid and small-scale energy solutions. This public-private partnership will leverage $1 billion in investments over five years to bring renewable solutions to communities in sub-Saharan Africa. In addition, the United States in collaboration with industry is developing modular wind and solar energy systems through the Remote Community Renewable Energy Partnership. These compact systems are designed to work in isolated communities. They could replace inefficient and expensive diesel generators.

61. The solar plan of Egypt moved forward by setting its concentrated solar power target at 2,800 megawatts by 2027 and its solar photovoltaic target at 700 megawatts. In Ethiopia in 2013, with international support, 23,000 solar home systems were installed and 2.5 million advanced cookstoves were sold. Ghana has set a goal of 10 per cent renewable electricity generation in the national generation by 2020. The Morocco energy strategy includes creating a diverse mix of reliable and competitive technologies, mobilizing renewable energy and other natural resources and promoting energy efficiency and effective integration into the regional energy system. The target share of renewable energy in the electric supply is 42 per cent by 2020. An institute of solar energy has been established, as well as renewable energy and energy efficiency networks, within institutes of higher education.

62. Belarus has planned the commissioning in the coming years of 160 additional sites that will generate power from renewable energy, 38 biogas facilities and construction and restoration of 33 hydropower stations. The national programme for development of local and renewable sources of energy for 2011-2015 includes the construction of wind installations (440-460 megawatts), 126 heat pumps and geothermal energy with total capacity of 8.9 megawatts and 172 solar water heaters and solar plants. Under the existing assessments, the implementation of the above programmes will result by 2015 in a two-fold increase of the use of renewable sources of energy.

63. Saudi Arabia will install at least 70 stations nationwide to measure the ability to produce electricity from sun, wind, geothermal and waste sources and plans to attract about $109 billion to create a solar industry that will generate a third of its electricity by 2032, or about 41,000 megawatts.

64. A growing number of cities, States and regions are committing themselves to a transition to 100 per cent renewable energy in individual sectors of the economy or in the economy as a whole. Djibouti, Scotland and Tuvalu are planning to generate their electricity requirements from 100 per cent renewable energy. British Columbia, Canada introduced a 100 per cent clean electricity standard for all new investments in electricity.

65. Stimulating rural off-grid renewable energy alternatives has been an area of focus for numerous countries. Among other efforts, Bangladesh is targeting 150,000 biogas digesters by 2016 and 2.5 million solar photovoltaic systems by 2015; Benin plans to achieve 50 per cent rural electrification by 2025; the target in Colombia is 30 per cent by 2030; Lesotho is aiming for 35 per cent rural electrification by 2020; and Uganda plans to have 100,000 biogas digesters installed by 2017.

C. International institutional efforts

66. Organizations of the United Nations system continue to support the promotion and expansion of new and renewable sources of energy in developing countries. The Secretary-General's Sustainable Energy for All initiative has brought attention and awareness to the important issues of universal energy access, energy efficiency and the promotion of new and renewable sources of energy.

67. The United Nations Development Programme (UNDP) is involved in many activities promoting the use of new and renewable sources of energy. One of its main initiatives is the creation of a hub for decentralized energy solutions designed to focus capacities and resources from all agencies on off-grid areas. UNDP provides technical assistance to develop sustainable energy solutions, particularly decentralized energy options to expand bottom-up approaches to sectors such as education, health, agriculture, youth employment, small enterprises and rural and urban housing. Through its programme on promoting access to clean and affordable energy systems and services, UNDP promotes distributed clean energy systems, focusing mainly on sustainable use of biomass and other renewable energies, delivering on-grid and off-grid electricity solutions and providing clean fuel for heating and cooking. UNDP support for the 2014-2024 Decade of Sustainable Energy for All includes the establishment of national targets and policy frameworks for renewable energy and development of regulatory frameworks that provide technical regulations and conditions for the installation of renewable energy generation plants and their connection to the grid. Other areas of support include generating methodologies for calculating costs for renewables-based electricity and standardized contract modalities for buying back electricity from renewable energy generation.

68. The World Meteorological Organization (WMO) and the International Renewable Energy Agency (IRENA) are collaborating on the Global Atlas for Renewable Energy by identifying and facilitating access to available datasets from WMO programmes. In the context of the Global Framework for Climate Services, WMO and IRENA have initiated a multi-stakeholder initiative to define the needs and requirements of the energy sector for climate services. Owing to their sensitivity to climatic factors, renewables are a particular focus of this effort. WMO advises on a modern, inter-operable data management system involving archiving and data service facilities to support the work of IRENA on renewable energy potentials, climate variability impacts and long-term sustainability and variability of renewable energy resources. One potential area for future WMO contributions is the implementation and maintenance of the land-based, marine-based and space-based observing programmes that will inform decision makers on energy potential at various sites, and therefore on appropriate sites for installation of potential renewable energy technologies.

69. The efforts of the Food and Agriculture Organization of the United Nations (FAO) focus on the Energy-Smart Food for People and Climate programme and the work on sustainable bioenergy. The energy-smart food systems programme promotes improved energy efficiency and diverse energy sources with gradual increase in the use of renewable energy in agriculture and food chains.

70. The United Nations Environment Programme (UNEP) has provided support to countries on promoting new and renewable sources of energy and energy efficiency

measures along three main work streams: assessments and analysis enabling science-based decisions considering the country-specific context; policy tools to design and implement an enabling framework for the uptake of sustainable energy technologies; and innovative finance and risk management for sustainable energy technologies, goods and services in developing countries. The UNEP Medium-Term Strategy 2014-2017 includes programmes on renewable energy, energy efficiency and decentralized energy solutions, among others. These are to be achieved through a transition to an inclusive green economy.

71. The World Health Organization (WHO) has the global household energy database, which serves as the baseline for Sustainable Energy for All tracking of home energy transitions and health impacts.[27] WHO focuses its work on the co-benefits of clean energy. WHO is documenting access to clean and renewable energy in the health-care sector at the national level. It has been raising awareness about benefits of renewable energy in health-care facilities. WHO prepared air quality guidelines for household fuel combustion to provide guidance on safe and renewable energy technologies to policymakers.

72. A recent study by the United Nations Industrial Development Organization (UNIDO) suggests that up to 21 per cent of all final energy use and feedstock in the manufacturing industry in 2050 can be of renewable origin; numerous business opportunities thus exist for a greater share of renewable energy in the energy mix. UNIDO currently has 50 active renewable energy projects in 35 countries and 20 projects in the planning stages. Its renewable energy programme promotes productive or income and growth-generating activities through mainstreaming the use of renewable energy in industrial applications. UNIDO has launched several multi-stakeholder initiatives such as the green industry initiative and platform and the clean technology programme for small and medium-sized enterprises. The UNIDO technology facilitation mechanisms include the global network of resource-efficient and cleaner production centres or RECP*net*, international technology centres, investment and technology and promotion offices, and centres for South-South industrial cooperation.

73. The work of the United Nations Conference on Trade and Development (UNCTAD) focuses on energy commodity development, greening international trade and decarbonizing the clean energy commodity supply chains. To this end, UNCTAD has introduced the energy commodity development programme, the natural resources information exchange and the biofuel initiative. UNCTAD works to address a number of issues, including obstacles to renewable energy trade and investment such as border energy tariffs and subsidies; the effect of government intervention on energy efficiency and prices; creating a level playing field between high-carbon and low-carbon investment alternatives; regional integration through grid interconnection for energy security; market-grid access for low-carbon technologies; and regional cooperation in the area of infrastructure investment, operations and management. Also, UNCTAD continues to work actively on promoting international cooperation and developing country participation in renewable energy sectors such as biofuels.

74. The Economic and Social Commission for Asia and the Pacific (ESCAP) developed a project on strengthening South-South cooperation to increase the

[27] See www.who.int/indoorair/health_impacts/he_database/en/index.html.

affordability of sustainable energy options in Asia and the Pacific. ESCAP is working on the creation of the Asian Energy Highway, an integrated regional grid that will support diversification within the energy generation mix. ESCAP is implementing a multi-year project to widen access to modern energy services for rural communities through the pro-poor public-private partnership for rural development.

75. The outcome document of the 2013 Asian and Pacific Energy Forum in identified advancing the development and utilization of renewable energy as one of 15 areas of action. A regional hub for Sustainable Energy for All was launched at the Forum to facilitate realization of the initiative's objectives.

76. The work of the Economic and Social Commission for Western Asia (ESCWA) on sustainable energy focuses on access to energy services, sustainable consumption and production and the promotion of renewable energy. ESCWA organized The second Arab Forum for Renewable Energy and Energy Efficiency, focused on enhancing the role of small and medium enterprises in promoting renewable energy and energy efficiency, in collaboration with several international organizations. The Forum initiated a regional dialogue on the development and use of renewable energy, including in rural and remote areas. ESCWA has a projects on enhancing and improving access to energy services through development of public-private renewable energy partnerships. In addition, ESCWA will be implementing a United Nations Development Account project on promoting renewable energy investments for climate change mitigation and sustainable development. Furthermore, a renewable energy training centre sited in a rural area of Lebanon is being developed, to be equipped with operational models of different renewable energy technologies appropriate for rural areas.

77. The Department of Economic and Social Affairs of the Secretariat leads a public-private partnership initiative on minimum electricity access that supports the electrification of rural isolated communities with new and renewable energy sources. In 2013, the Department conducted a global conference on capacity development for rural energy access. Follow-up activities resulting from this event are promoting the use of renewable energy in rural areas of a number of developing countries.

78. The strategy of the United Nations Educational, Scientific and Cultural Organization (UNESCO) includes assistance to Member States in enhancing the use of renewable energy technologies through effective policies and institutional frameworks. UNESCO launched the Global Renewable Energy Education and Training Programme. Under this programme, annual summer schools on renewable energy training are organized in Africa, South-East Asia and Central and Eastern Europe. UNESCO partnered with the Barefoot College to provide solar energy training that targets empowering women in rural communities in Africa. The Renewable Energy Futures for UNESCO Sites initiative promotes the use of UNESCO biosphere reserves and World Heritage sites as field observatories on the sustainable use of renewable energy sources. Another project launched by UNESCO is "Solar electrification of rural schools", which is designed to address energy access in Sub-Saharan African countries using solar energy systems.

79. The United Nations Human Settlements Programme (UN-Habitat) focuses on several energy areas, including renewable energy technologies in the urban energy mix. To this end, UN-Habitat has projects on (a) designing and implementing pilot

renewable energy projects to enhance pro-poor access to water and sanitation; (b) promoting biogas in public institutions such as schools, prisons, hospitals and public spaces; (c) developing multi-functional clean energy centres, including a multitude of renewable energy technologies; (d) producing best-practice casebooks and technology roadmaps for renewable energy use in human settlements; and (e) designing sustainable municipal solid waste management systems, with an emphasis on producing energy from waste.

80. The European Union announced the Energizing Development initiative that will provide access to sustainable energy services to 500 million people by 2030. By 2014, 10.33 million people were provided with sustainable energy access, as well as just under 12,000 institutions and more than 24,000 businesses. The Dutch-German-Norwegian-Australian-British-Swiss partnership has committed 245.8 million euros to the budget.

81. The European Commission has awarded 95 million euros in grants to energy access projects in Africa. Co-financing amounts to 155 million euros and will provide electricity access to 2 million people. Another commitment for 3 billion euros for projects in 30 countries is under way.

82. The International Renewable Energy Agency (IRENA) works towards mainstreaming renewable energy options and strategies in energy plans, increasing global access to renewable energy knowledge and improving policy frameworks and enabling market conditions for accelerated deployment of renewable energy. IRENA also works to facilitate regional cooperation, transform island energy systems and contribute to sustainable livelihoods through access to renewable energy. Its costing and energy policy analyses have collected real-world cost and performance data of over 9,000 utility-scale projects and some 200,000 small-scale solar photovoltaic systems. Its study on adapting renewable energy policies to dynamic market conditions supports policymakers in creating long-term support policies to promote the long-term transition to renewable sources and technologies. The Global Atlas for Renewable Energy is the largest free global database of the most comprehensive information on renewable energy resource potentials. Developed in partnership with a wide range of countries and other stakeholders, the Atlas is growing to include all sources of renewable energy. The IRENA renewables readiness assessment is a country-driven process for assessing key policies, potentials and technologies for renewable energy deployment and the actions necessary to create an enabling policy and decision-making framework. The *Renewable Energy and Jobs Annual Review 2014* presents the current status of employment for renewable energy technologies. To address growing needs in the renewable energy jobs market, IRENA also developed the Renewable Energy Learning Partnership, a global platform providing free access to all renewable energy education and information. IRENA is cooperating with the Abu Dhabi Fund for Development to facilitate project financing in developing countries. In 2014, IRENA awarded a total of $41 million in loans to six projects in Ecuador, Maldives, Mali, Mauritania, Samoa and Sierra Leone.

83. The International Fund for Agricultural Development (IFAD) works with poor rural communities to increase at scale the demand for clean energy products by linking access to energy to agriculture-related activities. Their projects include micro hydropower in Nepal, jatropha biofuel in Mali and solar-powered drip irrigation in northern Benin.

International finance institutions

84. International financial institutions continue to play an important role in mobilizing resources for the promotion of new and renewable energy. Multilateral development banks are committing more than $30 billion towards achieving the three goals of the Sustainable Energy for All initiative.

85. The World Bank Group has committed to doubling the leverage of its energy financing and to providing technical assistance to several Sustainable Energy for All opt-in countries. The World Bank Group has launched a global Sustainable Energy for All technical assistance programme, with $15 million of funding from the Energy Sector Management Assistance Programme (ESMAP). It will provide support to five countries in sub-Saharan Africa to expand energy access and build a portfolio of investment-ready projects. Other initiatives include the ESMAP effort to identify renewable resource "hot spots" for solar, wind, biomass and small hydropower potential through its renewable energy mapping programme. In 2012, the World Bank Group supported renewable energy projects with a total of $8.2 billion. Other World Bank-supported programs include: (a) delivering electricity by solar photovoltaic panels to 1.4 million low income rural households in Bangladesh with financing from the International Development Association (IDA); (b) expanding electricity services to 4,300 towns and villages in Ethiopia through three IDA credits over five years; and (c) supporting an electricity rollout programme in partnership with the Government of Rwanda that tripled electricity connections from 2009 to 2012. On the analytical side, the World Bank Group led a team of experts from 15 agencies to produce the 2013 *Sustainable Energy for All Global Tracking Framework Report*.

86. The African Development Bank will invest $20 billion in energy by 2030. Investments range from regional to small- and medium-scale energy projects to increase electricity access in rural regions, including through its Sustainable Energy Fund for Africa. Its Africa Renewable Energy Fund was ramped up to $100 million by February 2014. The Bank has approved $2 billion for projects and mobilized $4.5 billion in co-financing since the United Nations Conference on Sustainable Development.[28]

87. The European Bank for Reconstruction and Development committed $8 billion to sustainable energy financing and is expected to exceed that number by the end of the year.[29] More than 300 projects were implemented in the past in Central and Eastern Europe and the southern and eastern Mediterranean, avoiding 19.6 million tons of CO_2 annually.

88. The Global Environment Facility (GEF) has invested over $1.2 billion in more than 200 renewable energy projects in almost 100 developing countries and economies in transition. These investments have been augmented by an additional $8.3 billion in co-financing. The GEF has contributed to the installation of more than 3 gigawatts of electric capacity and 2.8 gigawatts of thermal capacity based on renewable energy. Since 2012, the climate change focal area of GEF has approved $37 million for rural electrification, renewable energy, energy efficiency and low-carbon city development projects.

89. The United Nations Capital Development Fund (UNCDF) CleanStart programme provides microfinancing to low-income households for clean energy

[28] Sustainable Energy for All, "SE4All results and deliverables: Partners making progress" (www.se4all.org/2014/06/04/se4all-results-deliverables-partners-making-progress-2/).

[29] Ibid.

solutions. The objective is to provide 2.5 million people with cleaner, more efficient energy by 2017. The programme has a budget of $60 million that can potentially reduce 300,000 tons of CO_2.

90. The Scaling-Up Renewable Energy Programme for Low-Income Countries approved grants to Armenia and Solomon Islands for the preparation of their investment plans. The Programme received $26 million in additional funds from Sweden, which also increased contributions to the Adaptation Fund and the Least Developed Countries Fund.

IV. Conclusions

91. New and renewable sources of energy are perceived now globally as important and valuable options for energy supply and as key resources for addressing global challenges, including universal energy access, energy security, climate change and ultimately poverty eradication and sustainable development.

92. Continuing technological advances and rapid deployment of renewable energy systems in many developed and developing countries have demonstrated their potential to satisfy energy requirements and successfully replace alternative energy sources.

93. The Sustainable Energy for All initiative has made remarkable progress in promoting new and renewable sources of energy over the past years and is leading the international community into a major transformation of energy systems.

94. The resolution declaring 2014-2024 the Decade of Sustainable Energy for All is already triggering supporting projects and programmes by many Member States, United Nations agencies and international organizations. Integrated strategic programmes and partnerships are being created to reach the global objectives of the Sustainable Energy for All initiative. The Special Representative of the Secretary-General for Sustainable Energy for All will work towards putting in place long-term institutional arrangements in support of the initiative, both within and outside the United Nations, including the establishment of an "international not-for-profit" organization and appropriate arrangements.

95. As renewable energy markets and industries mature, new opportunities arise, but at the same time different challenges and uncertainties appear. The last two years have seen declining investments owing to the international economic crisis, changes in national policy environments and potential competition from new discoveries of unconventional fossil fuel resources.

96. Nevertheless, 2013 and 2014 have seen a continuous increase in global renewable energy use and in the number of countries with renewable energy targets and supporting policies.

97. However, much more needs to be done to make the growth in renewable energy self-sustaining and to pursue the accelerated deployment necessary to achieve critical universal goals.

98. In order to limit emissions from energy generation and to support the transition to clean energy systems, there is a need to increase investments in renewable energy deployment and development and improve energy infrastructure and energy efficiency.